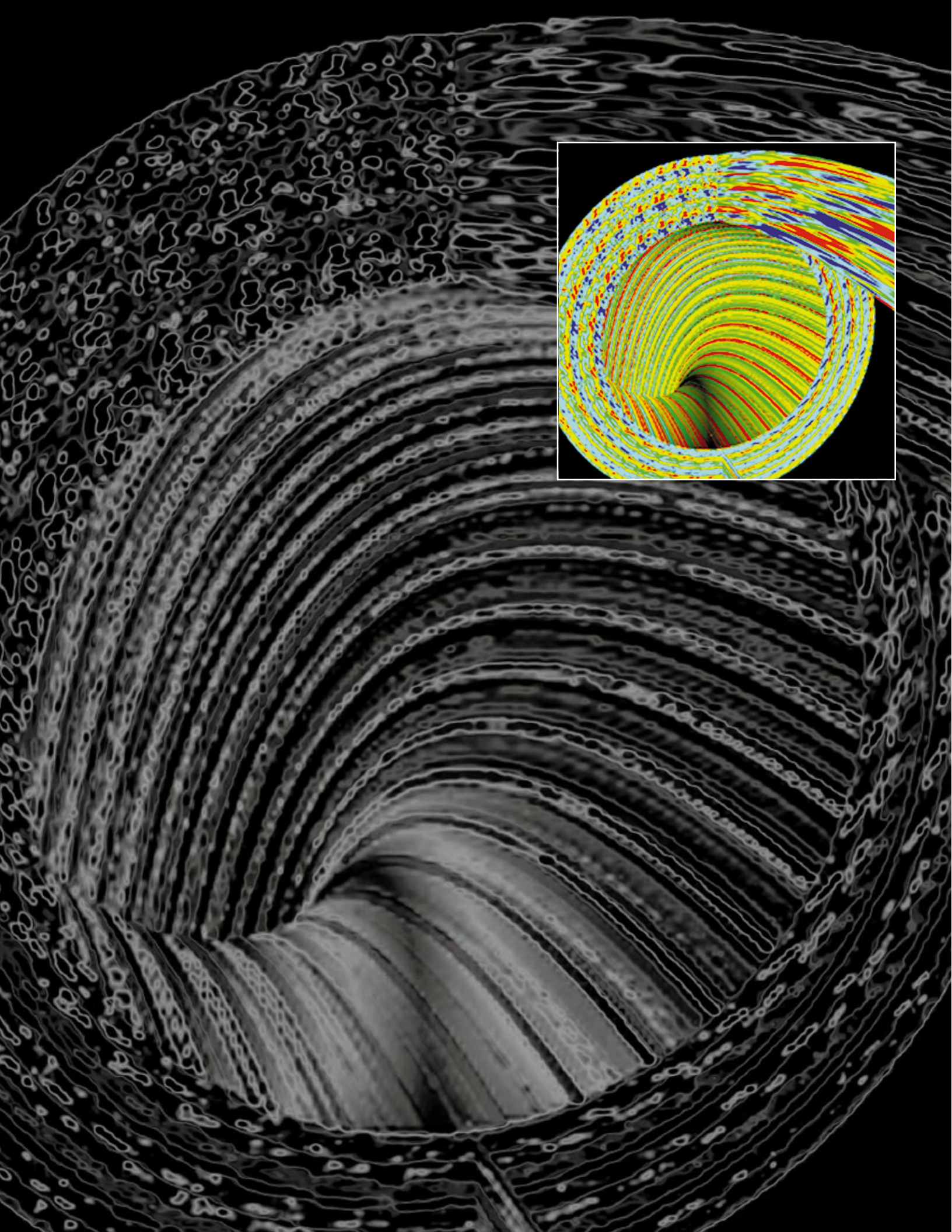


MISSION-DIRECTED SCIENCE AND TECHNOLOGY

Livermore's multidisciplinary teams excel in conducting large-scale research and development aimed at solving important national problems.

Stable mission responsibilities provide the Laboratory with considerable program continuity, enable an institutional accumulation of knowledge and expertise, and foster investments in new facilities and capabilities. We have developed wide-ranging capabilities in applied science and technology and unique expertise in selected areas. Livermore's programmatic successes stem from our focus on problem solving, the strength of the Laboratory's science and technology, the quality of our staff, and the use of effective partnerships to enhance the Laboratory's capabilities and provide a means for sharing technologies with others. Success demands effective technical project management to ensure that deadlines and budgets are met and that the product meets or exceeds the customer's expectations.

A NATIONAL RESOURCE OF SCIENCE AND TECHNOLOGY

The Laboratory is a national resource of science and technology with an extensive science and technology base and many specialized centers of excellence. Livermore provides leadership in several broad research areas that are central to the Laboratory's missions.

An Extensive Science and Technology Base

Livermore programs are supported by a large technical base consisting of more than 1,000 Ph.D. scientists and engineers. A significant portion of the scientific staff is organized into "discipline" directorates—Chemistry and Materials Science, Computations, Engineering, and Physics—and many of these people are matrixed, or assigned, to specific programs. Use of the matrix system fosters efficient transfer of technical knowledge among programs, enables staff members to develop a wide-ranging set of skills and knowledge, and infuses projects with diverse ideas for solutions. As a result, the Laboratory has the ability to seize program opportunities, the agility to react quickly to technical surprises, and the flexibility to respond to programmatic changes.

• Assessing and Ensuring the Health of the Science and Technology Base. The ability to sustain an excellent base of science and technology is fundamentally important to the Laboratory's current and future programs. Significant changes are under way at Livermore in the way we assess the health of the science and technology base and make strategic investments to maintain its vitality. Ongoing improvements in the method for accounting for internal costs are enabling Laboratory managers to better monitor internal investments and rebalance them, as necessary, to ensure a healthy technical base and effective use of the matrix system. We will be implementing new approaches to assessing the quality of the Laboratory's core capabilities in science and technology. We plan to benchmark Livermore's work against the highest national and international standards, and we will use these assessments to guide science and technology investment decisions.

Specialized Centers of Excellence

Many specialized centers of excellence exist at Livermore. Because of our overall size, the need for technologies and capabilities that do not exist elsewhere, and the fact that essential elements of our national security mission are classified, much of the necessary expertise to support programs resides within the Laboratory. For example, we have capabilities to develop state-of-the-art instrumentation for detecting, measuring, and analyzing a wide range of physical events. We also have expertise to support innovative efforts in advanced materials, precision engineering, microfabrication, nondestructive evaluation, complex-system control and automation, and chemical, biological, and photon processes.

Computational models are developed by Livermore researchers to augment experimental work, in this case to predict plasma transport in a tokamak fusion experiment.

Leadership in Research Areas Central to Our Missions

The Laboratory's many research and development accomplishments demonstrate Livermore's leadership in several broad research areas.

• **High-Energy-Density Physics and Nuclear Science and Technology.** For over 45 years, the Laboratory has demonstrated excellence in science and technology directed at the development of nuclear weapons and the harnessing of thermonuclear and fission energy for civilian power. We have broad expertise in nuclear science and technology as well as exceptional capabilities for investigating the properties of matter at extreme conditions (up to stellar temperatures and pressures) and the interaction of matter with intense radiation. This expertise will remain crucial for our national security programs. It will also be applied to develop innovative techniques for environmental cleanup, assist the Department of Energy in the stewardship of nuclear materials, and advance fundamental science in many areas.

• **Advanced Lasers and Electro-Optics.** Livermore is the pre-eminent laser science and technology laboratory in the world. We are strongly focused on two high-priority efforts—meeting design and construction goals for the National Ignition Facility and successfully completing the transfer of uranium atomic vapor laser isotope separation to the private sector. We are also applying the Laboratory's expertise in lasers and electro-optics to meet other national needs, contribute to the competitiveness of U.S. industry, and address issues in basic science.

• **High-Performance Scientific Computing.** Over the next decade, we will be acquiring successively more powerful computers with the goal of achieving increases in computational speed and data capacity by a factor of 100,000. By December 1999, we expect to have a 10-teraflops computer (10 million megaflops), capable of performing calculations in 5 minutes that currently would take 40 days to complete. While meeting the Laboratory's commitments to national security programs, we are making internal investments to ensure that all major Livermore programs have access to these advanced computing capabilities. They offer the potential of revolutionizing scientific discovery and leading to unprecedented levels of understanding in climate and weather modeling, environmental studies, the design of new materials, and many areas of physics.

AN OUTSTANDING WORKFORCE

The Laboratory's principal asset is its quality workforce. We will seek highly talented, productive, motivated, flexible people who are committed to Laboratory goals and reflective of the diversity of California and the nation. Our recruitment, reward, and advancement decisions will be based on contribution to Livermore's success. We will recognize and reward both team excellence and individual accomplishments. We expect all employees to take pride in and responsibility for their work, improve their skills, and continue their professional growth.

Expertise in advanced lasers and associated technologies, necessary for the National Ignition Facility and other major projects for national security, provides program opportunities in laser isotope separation, inertial confinement fusion, advanced lithography, and other diverse applications.

Requirements and Opportunities for Advanced Lasers

Challenging scientific programs, world-class research facilities, and a collegial environment are critical to attracting and retaining an outstanding workforce.

• **Creative Research Opportunities for Scientists and Engineers.** Challenging scientific programs, world-class research facilities, and a collegial environment are critical to attracting and retaining an outstanding workforce. The Laboratory will pursue state-of-the-art science and engineering to achieve breakthrough accomplishments in all of its major programs. The diversity of opportunities that exist at Livermore offers the technical staff many options for career changes and career growth.

• **Valuing Breakthrough Achievements.** The Laboratory greatly values and will recognize and reward outstanding scientific and technical achievements by individuals and research teams. Breakthrough accomplishments are critical to the success of Livermore's programs and provide the foundation for future programs to meet national needs. Frequently such achievements lead to international honors such as E. O. Lawrence Awards, R&D 100 Awards, and other distinguished prizes and awards presented by professional societies.

• **A Part of the University of California.** The Laboratory's association with the University of California will continue to make a significant difference in the decision of people to work at Livermore. The strong bond between Livermore and the University nurtures an atmosphere at the Laboratory in which independent views and technical honesty are treated as core values, and it has led to an array of scientific and technical associations that would not have been achievable otherwise. We place great importance on continuing and further strengthening this relationship.

PARTNERSHIPS THAT CREATE NEW CAPABILITIES

Partnering has been important at the Laboratory ever since Livermore's establishment as part of the University of California and the early days of supercomputer development to meet the needs of the weapons program. It will play an even more significant role in the future. Working with industry, academia, and other partners strengthens and adds vitality to the Laboratory. Partnerships and collaborations help us accomplish our programmatic goals more efficiently and cost effectively. They reinforce our strengths by helping us excel at what we do best. And they provide us capabilities not existing at the Laboratory. We also work with others to share expertise or make available research capabilities. We strive to be known as a center for science and technology and will provide wide access to the Laboratory's experimental facilities and staff.

Partnering activities will span a wide range—from very-large-scale strategic alliances to licensing of individual technologies, academic research, and support for the small business community. Partnerships will be woven throughout the fabric of Livermore's major programs. The National Ignition Facility is a major collaboration with Los Alamos, Sandia, and the University of Rochester, as well as the French CEA-Division Applications Militaire and the British AWE-Ministry of Defence. Over 75% of the total funding for construction of the NIF will go to U.S. companies, including high-technology firms producing optical components. The NIF will support cutting-edge collaborative research in astrophysics, plasma physics, and many other fields.

As part of the Accelerated Strategic Computing Initiative (ASCI), Livermore, Los Alamos, and Sandia will be purchasing from U.S. industry

The Livermore Approach to Problem Solving

Multidisciplinary Research Teams. We form multidisciplinary teams tailored to meet the demands of each challenging problem. The teams combine scientific and engineering talent, and they draw from a diverse mixture of knowledge, skills, and experience to generate innovative solutions. Increasingly, research efforts entail partnerships with others outside the Laboratory as well.

An Integrated Approach to Research and Development. Research and development activities at Livermore span the range from fundamental science to production engineering of complex systems. For our customers, we often carry concepts all the way from scientific discovery to fully developed prototype products.

Large-Scale Experimental Science and Engineering Development. We design and develop both products for our customers and large-scale experimental facilities, which we then use as tools to achieve program goals.

Computer Simulation of Complex Systems. Computer simulation is often the most cost-effective means for "conducting" a large number of complex experiments. Confidence in modeling results depends on careful validation through actual experiments. The use of simulations and experiments is mutually reinforcing.

We strive to be known as a center for science and technology and will provide wide access to the Laboratory's experimental facilities and staff.

increasingly capable supercomputers. ASCI is a partnership involving the three laboratories, industry, and academia to drive the advancement and refine these prototype machines, which will help ready them for the wider marketplace. At Livermore, we are working closely with IBM and took delivery in 1996 of the first elements of IBM's most capable supercomputer (the 512-node SP). Additional elements to increase the computer's capabilities are planned for delivery by the end of 1998, leading to a machine with an operating speed of 3 teraflops—about 300 times faster than our previous best computer.

Partnerships with Industry

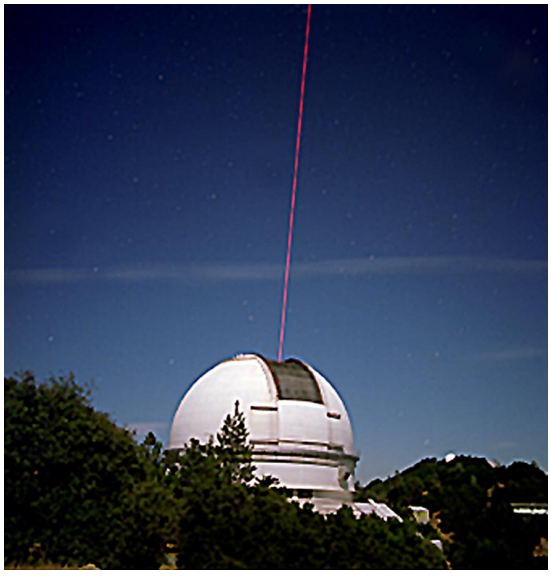
We anticipate that the Laboratory's partnerships and alliances with industry will continue to grow. For example, we will apply Livermore's expertise in microfabrication and micro-electronics to develop new lithography capabilities for the production of advanced computer chips, which will lead to improvements in the Laboratory's computing capabilities. This collaborative research and development project will involve Lawrence Berkeley and Sandia national laboratories together with an Intel-led consortium of micro-electronics companies. Livermore will also be part of the virtual national laboratory, a Department of Energy partnership to address critical technology needs for the Department and U.S. industry. We will form partnerships through a variety of mechanisms such as memoranda of agreement, cooperative research and development agreements, non-federal Work for Others agreements, cost-shared procurements, licenses, and software collaborations.

• **Licensing Agreements.** We will collaborate with industry through the licensing of Livermore-developed technologies, such as our revolutionary micropower impulse radar—the so-called radar on a chip—which has many potential applications.

• **Cooperative Research and Development.** We will work with U.S. industry through a variety of cooperative research and development arrangements in which intellectual property rights are negotiated. Future growth in this area will depend on the technical success and businesslike management within the Laboratory of current cooperative activities. We will examine and implement innovative ways to work with industry, such as the establishment of Laboratory-affiliated not-for-profit companies or foundations. These arrangements will help support our technology base, provide even greater community outreach and exposure to modern business practices, assist in the recruitment and retention of a quality workforce, and lead to important "spin-backs" to Laboratory programs.

Collaborations with Academia

We will continue to increase our many formal and informal collaborations with the University of California campuses and other academic institutions. The University of California at Davis Department of Applied Science is located on the Livermore site. In addition, we are home to several University of California scientific research institutes and other centers that support hundreds of ongoing projects with faculty, postdoctoral fellows, and graduate students. By making Livermore's major research facilities and staff more accessible to the academic community, we gain access to a larger pool of talent, which helps us accomplish our programmatic goals while providing valuable opportunities to visiting researchers. We also will help to train the nation's next generation of scientists and engineers through our science and technology education outreach programs.



Livermore's laser guide star adaptive optics system can improve the resolution of ground-based telescopes by more than tenfold.

Livermore's goal is to serve and be valued as an intellectual asset and contributing neighbor in the San Francisco Bay Area and California.

Teamwork with Other Laboratories

We will work with other national laboratories—both in the U.S. and abroad as appropriate—to coordinate and integrate programmatic efforts to provide the best scientific and technical capabilities for the dollars invested. Livermore's collaborative activities are increasing through participation in integrated national programs, such as the Stockpile Stewardship and Management Program and the Joint Genome Institute. Collaborations will include the design, construction, and shared use of major research facilities such as the National Ignition Facility and the B-Factory at the Stanford Linear Accelerator Center. Critical success factors will be effective high-level Department of Energy leadership, well-defined program goals and deliverables, complementary capabilities among the national laboratories, confidence in each other's commitment and performance, and a healthy competition of ideas within a collaborative framework.

A Home in California

California is a special place. We share in its diversity, its emphasis on high technology, its global outlook, and its focus on the future. We also have common science and technology interests—water conservation, seismic safety, natural resource management, energy use and transportation, environmental protection, and science education. Many of these same complex issues are also challenging the nation. We will apply Livermore's expertise in these areas to provide the technical basis to support effective decisions. Livermore's goal is to serve and be valued as an intellectual asset and contributing neighbor in the San Francisco Bay Area and California. We must assure honest, open interactions with the communities around us—we want them to be proud that we are here.

Principal Research Centers and Facilities at Livermore

Atomic Vapor Laser Isotope Separation Facility—advanced capability for industrial-scale research on uranium processing.

Center for Accelerator Mass Spectrometry—most versatile spectrometry capability in the world.

Chemistry and Materials Science Environmental Services Laboratory—wide-ranging capability to provide chemical and radiochemical characterization of environmental samples.

Conflict Simulation Laboratory—state-of-the-art, interactive, entity-level conflict simulation.

Electron Beam Ion Trap Facility—first achievement of totally ionized uranium without use of a high-energy accelerator.

Flash X-Ray Facility—currently the most capable hydrodynamic testing facility in the world.

Forensic Science Center—world leadership in development of new forensic capabilities and instrumentation.

Genome Center—home of world's largest collection of cloned genes and the most detailed map of a human chromosome.

High Explosives Applications Facility—world's most modern high-explosives research facility.

International Assessments Center—national resource for evaluations of foreign weapons programs.

Large Optics Diamond Turning Machine—world's most accurate machine tool for fabricating large metal optical parts.

Microtechnology Center—world leader in laser-based microtechnology development.

National Atmospheric Release Advisory Center—for real-time emergency predictions for hazardous substance releases.

Nova Laser—the world's primary research tool for inertial confinement fusion.

Petawatt Laser—the world's most powerful laser.

Plutonium Facility—modern facility for nuclear materials research and testing.

Positron Microscope—world's most intense pulsed proton beam for studying material defects.

Secure and Open Computing Facilities—the Laboratory's supercomputers and testbed for hardware and software development.

Superconducting Magnet Test Facility—unique development testing facility for large superconducting magnets.

Two-Stage Gas Guns—first achievement of metallic hydrogen.